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ABSTRACT

Research is reviewed that centers on the development of young children's metamemoric ability and the relationship between such ability and memory performance. In addition, implications of the research for training and education are indicated. Components of Flavell and Wellman's (1977) definition of metamemory are used to organize the discussion. Specifically, sections of the paper (1) report research on children's understanding of the demands of memory tasks, (2) discuss young children's understanding that characteristics in the person can influence memory performance, (3) describe children's increasing recognition that task variables influence the ease of storing and retrieving information, (4) briefly indicate limitations of children's use of planful behavior or strategies in storage and retrieval, (5) take up the issue of the relative absence of research on the interaction of metamemoric components, (6) review research on children's memory monitoring abilities and their use of feedback to modify recall, (7) discuss research on the relationship between metamemory and memory performance, and (8) suggest outcomes of metamemoric training. It is concluded that research indicates many differences between the metamemoric understanding of young children and that of older children and adults. The suggestion is made that recognition of these differences by early childhood educators can influence the type of environmental experiences provided children and the memory task demands made of them. (RH)

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HOW DO I REMEMBER?: YOUNG CHILDREN'S UNDERSTANDING OF THE MEMORY PROCESS

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Running Head: How Do I Remember?

Abstract

Children's understanding of their memory process or their metamemory ability develops throughout the preschool and school aged years. These developmental changes have been the focus of much research. This paper reviews the relevant research on the development of young children's metamemory ability, the relationship between their metamemory ability and memory performance, and the training and educational implications of this research.

How Do I Remember: Young Children's Understanding of the Memory Process

"Go upstairs and bring down your shoes and socks." What color are your new pants?" "Mary had a little lamb..." "A, B, C, D...". All of these tasks we ask of young children require many skills and an understanding of the memory process. Recent research has described the development of these memory skills and understanding across the preschool and school-aged years. The purpose of this paper is to review and discuss the research on the development of young children's (3-7 years) understanding of their memory process or their metamemory ability.

Metamemory as defined by Flavell and Wellman (1977) includes the knowledge: 1) that memory situations call for effort and memory related activity, 2) that person factors or characteristics (e.g., limitations of ability) can influence memory performance, 3) that some task factors (e.g., number of objects, amount of study time, type of items) can influence memory performance, and 4) that cognitive strategies (e.g., repetition, grouping) can facilitate performance. Metamemory includes not only a consideration of each of these four components, but also, the interaction of the components (i.e., the interaction of the age of the child, with the number of task items, with a grouping strategy). Finally, metamemory involves the self-monitoring of the various factors during the memory process. For example, internal decisions are made regarding strategy selection, strategy effectiveness, readiness for recall, the use of restudy time and the need for further search.

Memory Tasks Require Effort

The first knowledge component concerns children's sensitivity to the fact that memory tasks often require effort for successful recall. Early research (Appel, Cooper, McCarrell, Sims-Knight, Yussen & Flavell, 1972) compared children's study behavior and recall on two tasks, one with instructions to memorize for future recall, and the other with instructions to just look carefully. This research found that 4 yr. olds, failing to differentiate between the demands of the two tasks, performed equally on both tasks. The 11 yr. olds, clearly differentiating between the tasks, had higher recall on the task requesting memorization. The 7 yr. olds had a begining grasp of the implications of the memorization instruction but had few study skills to facilitate their performance on the memorization task.

Later research with simpler, more meaningful and interesting tasks, has suggested that young children do have a beginning understanding of the demands of memory tasks. For example, 4½ to 5½ yr. olds will look more at a model if explicitly told to remember in order to reproduce later (Yussen, 1974). Also 4 yr. olds attend to a model longer under the task condition to remember the items because later we will play a game with them, then under the condition to simply remember the items.

Even 3 yr. olds had some understanding of the demand for effort on memory tasks. For example, they had higher recall of the location of a set of keys dropped during a walk when given the fore-knowledge to remember the site, than when not given this fore-knowledge (Acredolo, Pick & Olsen, 1975). Similarly, 3 yr.

olds had higher recall when given the instruction to "remember where the toy is hidden" as opposed to the instruction to "wait here with the hidden toy" (Wellman, Ritter & Flavell, 1976). In addition, children told to remember rather than wait exhibited more memory related behavior during the delay time. While waiting these children tended to touch or look at where the toy was hidden. Thus, if the task is interesting and motivating to preschool children they do realize that a memory task requires effort. They understand that an instruction to remember is a call for memorization activities. However, these activities are limited to touching and looking.

Person Variables

Developmental changes in children's understanding that characteristics in the person can influence memory performance have also been found. With age and experience children begin to understand their personal memory limitations and capabilities. Their mnemonic self-concept becomes more elaborated and differentiated.

Generally, young children's understanding of the boundaries of their short-term memory ability is quite limited. When asked to predict the number of pictures they could successfully recall, nursery and kindergarten children often over-estimate their short-term memory span. In a study by Flavell, Friedrich and Hoyt (1970), over one half of the 4-6 yr. old children predicted that they could remember all 10 items (the maximum number of items). Fewer than one third of the 7-10 yr. olds over-estimated their memory capacity.

When asked why they could remember as many as 10 items, young

children's reasons referred to their personal ability ("because I have a good mind" or "cause I have a good rememberer"),or their personal familiarity or preference for the objects rather than to the number of objects (Worden, Sladewski, & Awig, 1979). Their unrealistic predictions are not due to a lack of understanding of the demands of the task, i.e., to make a prediction. Five year olds were asked to predict the number of items they could recall and to predict how far they could jump. While their predictions of the cognitive action of memory recall were highly inaccurate, their predictions of the physical action of jumping were much more accurate (Markman, 1973).

Although young children do not understand the end points of their short term memory they do have some sense that it is limited. When asked whether it would make a difference if they got a drink before calling a just heard phone number, kindergarten children realized that it would make a difference (Kreutzer, Leonard, & Flavell, 1975). Immediate recall was preferred to delayed recall. Also 3, 4, & 5 yr. olds generally felt that they would have better recall with the help of a friend than without help (Wellman, 1977). In the same study, another person variable, age, was understood by preschoolers. They responded that a baby would recall less than an older person.

It seems then young children recognize some of their limitations and capabilities but they are certainly still in the beginning stages of developing their mnemonic self-concept.

Task Variables

With increasing age children come to recognize that certain

variables in the task can influence the ease of storing and retrieving information. Stimuli variables such as whether the items to be remembered are related, familiar, or numerous, can influence task difficulty. Also task conditions such as verbatim vs. paraphrased recall, and length of study time must also be considered.

Young children seem to have limited understanding of the facilitative quality of relationships existing among stimuli to be remembered. For example, when asked to predict the relative difficulty of sets of related or categorized objects versus sets of unrelated objects, children 7 yrs. of age did not recognize the relative ease of recall of categorized items (Moynahan, 1973). Similarly, when asked to generate their own lists for recall, young children produced a list of unrelated words. Older children, however, utilizing the mnemonic strategy of categorization, produced lists containing related words (Tenney, 1975). In another study, 6 and 7 yr. olds given two lists--one list containing names and actions, and the other list containing highly associated antonyms--recognized the relative ease of the antonym list when the two lists were of equal length. However, when the experimenter added one more pair to the antonymn list, it was then seen as more difficult than the name-action list. Most 6 and 7 yr. olds failed to recognize the much greater ease of the semantically related items.

Younger children had only a beginning understanding that tasks requiring verbatim, "word for word" recall was more difficult than tasks requiring paraphrased, "in your own words", recall (Kreutzer, et.al., 1975). By first grade, children sensed that longer length

of study time may result in better recall. For example, they preferred 5 minutes to study 20 pictures than 1 minute (Kreutzer, et.al., 1975). However, they did not take into account the length of time the items would have to be remembered when considering amount of study time. Four and six year olds studied for the same length of time whether they were asked to remember the items for a few minutes, 1 day, or 7 days (Rogoff, Newcomb, & Kagen, 1974).

There are however, several task variables that young children do understand. Preschool children definitely understand that the number of items and their familiarity with the items influences difficulty (Kreutzer, et.al., 1975). They also realize that noise or distraction could be a detriment to memory performance (Wellman, 1977).

Strategies

Successful memory performance often requires the use of planful behavior or strategies both at the time of storing and at the time of retrieving the information for recall. Young children's understanding of the facilitative nature of strategies is very limited.

As cited earlier, young children do not understand the role of categorized information. When asked to suggest a strategy for potentially categorizable information, they suggested categorization less often than older children. A developmental trend in the suggestion of the memory strategy of rehearsal, the repetition of the names of the objects, has also been found (Kreutzer, et.al., 1975). The main strategy that young children seem to

understand is "looking" and "touching". Although it is helpful to look and touch, these strategies have only limited potential.

The amount of planfulness for the retrieval of information also shows changes with age. Children were asked to imagine going skating with a friend after school the next day and then asked how would they remember to take their skates the next morning. Older children offered more mnemonic strategies and showed more planfulness in their responses than younger children. Similarly, when asked to think of things to do to find a lost jacket, older children tended to go backwards in their memory search (i.e., If the last place I went was _____, then I'll look there first. If it is not there, I will go _____ because I went there next). Younger children did not exhibit this level of planfulness (Kreutzer, et.al., 1975). The limited use of strategies and lack of planfulness among young children may account for their lower memory performance as compared to older children.

Interaction of Variables

Although most of the research has looked at each of the components of metamemory separately, in reality they interact with each other. For example, certain types of information may be easier for some people than other types (Task x Person) or a strategy may help on one task but not on another (Task x Strategy), or strategy effectiveness might depend on both the task and the person (Strategy x Task x Person).

Little research has looked at young children's understanding of a combination of factors upon memory performance. In a recent study (Wellman, Collins, & Gliebman, 1981) preschoolers, second

graders, fourth graders, and adults were asked to assess simultaneously the influence of number of items and amount of effort upon memory performance. Subjects were asked to predict the number of items they could recall give tasks having three different number of items--4, 8, and 12, at three different levels of effort--zero, little, and much. Even preschoolers realized that memory performance was the joint product of number of items and amount of effort. In this situation preschoolers were able to consider two variables simultaneously. However, young children's conception of how these variables interacted differed from older children's and adult's. The amount of information to be remembered played a lesser role in young children's conception than amount of effort. For young children, if one tried hard even a large number of items could be recalled. Given that in reality memory variables interact in numerous possible ways, future research in this vein should prove fruitful.

Memory Monitoring

Not only is knowledge of person factors, task factors and strategies important for successful memory recall, but the constant self-monitoring of these factors is necessary. During the memory process some questions one might ask oneself are: 1) Am I ready for recall or do I need to study more?, 2) If I need to study more, what do I need to study?, 3) Have I recalled all the items or should I search for them?, 4) If I remembered five items on that task, then how many items will I remember on this similar task?, 5) What strategy would help on this tasks? and, 6) Did the strategy help? Although memory monitoring is a very difficult area to study because of its internal nature, some research has

investigated the limitations and capabilities of young children's memory monitoring.

Young children are somewhat aware when they have or have not completely recalled all of the items (Moynahan, 1970). When presented the items, they also can recognize those items they had or had not recalled (Masur, McInture, & Flavell, 1973). However, when asked to predict their readiness for recalling a set of items, 4-6 yr. olds were not very accurate, (Flavell, et.al., 1970). In addition, when given a chance to restudy missed items, first grade children studied as many already passed items as missed items. First grade children did not understand the value of spending more time on missed items.

Finally, the research results on children's use of feedback to modify recall are inconclusive. Markman (1973) found that some 5 yr. old children who grossly over-estimated their memory capabilities (i.e., estimated 10 items) improved their prediction accuracy when given either feedback about their accuracy or practice in prediction. For others however, these experiences did not influence their behavior. In another study, Yussen and Levy (1975) found suprising resistence among 4 yr. olds to give realistic memory estimates. These children, given the experience of recalling a sequence of 10 items (and failing), still predict that they could recall 10 items. The preschoolers seemed aware of their failure but said things like "If you gave me a different list, I could do it" (Yussen & Levy, 1975, p.507). Thus, young children still have much to learn in the area of memory monitoring.

Metamemory and Memory Performance

The previously reviewed research reveals that young children certainly have many insights into their very complex memory system. They do understand about some of the limitations of short term memory, about task qualities such as object familiarity, numerosity, and amount of study time, and about the need for effort on memory tasks. However, their knowledge of the end points of short term memory, of strategies, and about monitoring their memory process is very limited. This lack of awareness and knowledge may explain the lower memory performance among young children as compared to older children and adults.

The link between knowledge and performance has been a major impetus in the metamemory research. The assumption is that children's understanding of the memory process should influence memory performance. Research results to date investigating this assumption are mixed. Some research have reported a positive relationship (Salatas & Flavell, 1975; Trepanier & Casale, in press) while others reported no relationship (Cavanaugh & Borkowski, 1979; Kelly, Scholnick, Travers, & Johnson, 1976).

A major problem in the research is a too simplistic view of the relationship between metamemory and memory performance. As already described, the metamemory components operate simultaneously rather than singularly. Also a differential weighing of the components on different tasks or times may also occur. In addition, metamemory is just one component in memory performance. Factors such as motivation and previous environmental experiences must also be considered. Thus, it seems that the relationship

between metamemory and memory performance is very complex.

Metamemory Training

Finally, since metamemory is an important element in memory performance and since young children's ability is so limited, the question arises whether their memory performance can be improved through metamemory training. The question of training metacognitive skills to improve performance is currently receiving much research attention.

Research by Kennedy and Miller (1976) suggested that those kindergarten children trained in rehearsal and given feedback about its effectiveness continued to use the strategy. Those children given rehearsal training but no feedback did not continue to use rehearsal. This type of training, informed training, can facilitate performance. One problem with informal training is that it does not include the very necessary component of self-monitoring.

In self-control training studies by Brown and others, children are taught not only to produce the strategy but also to monitor, check, and self-regulate its effectiveness. For example, in a study with mildly retarded children (MA = 8 yrs.), children were taught the study time activities of rehearsing the list, anticipating list items before exposing them, and self-checking. Such training resulted in immediate beneficial effects, maintenance of the strategy, and generalization to other tasks (Brown, Campione, & Day, 1981). Research with learning disabled children has also suggested that improved performance can result from metacognitive training (Wong, 1980, 1982).

Most of the research to date on metacognitive training has been conducted with older retarded, or learning disabled children. A word of caution, however, must be considered when applying this type of training or any strategy training to younger children. The effectiveness of the training may be dependent upon developmental readiness for training. For example, in the Brown study, metacognitive training was not effective with younger retarded children (MA = 6 yrs.). It is unknown at this time whether young children are developmentally ready for such monitoring of their memory process.

Conclusions

The metamemory research has revealed that young children are in the process of developing an understanding of the many person, task, and strategy factors that can influence memory performance. Many differences occur between young children's understanding and that of older children and adults.

Recognition of these differences by early childhood educators is very important. An awareness of these differences can influence the type of environmental experiences we provide and the memory task demands we make of young children. For example, adults can use an elaborate system of mnemonic strategies such as rehearsing the names of the items, categorizing the items into groups, and associating meaning to facilitate their memory performance. Adults often expect young children to have similar capabilities. However, young children are totally unaware of such strategies.

Teachers can perhaps facilitate the development of awareness and use of strategies by providing children with meaningful, interesting memory tasks, helping children become aware of the meaning and relationships, modeling mnemonic strateies, providing feedback about the children's performance, and encouraging self-checking and monitoring activities. Such techniques in interaction with the developmental readiness of the child may influence memory performance.

Future research on the interaction of person, task, and strategy factors, the monitoring of these factors, and the possible training of metamemory to improve memory performance is very necessary. Such research should provide further insights into our understanding of the development of young children.

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